UAS Case Studies

New Hampshire Department of Transportation

Unmanned Aircraft Systems (UAS) are a new capability that has the potential to reduce costs dramatically and increase safety for transportation operations. Despite the considerable amount of existing research and case studies surrounding UAS, there appear to be few, if any, that have focused on analyzing the costs, benefits, and barriers associated with integrating UAS into a state department of transportation's operations. The overall objective of this project focused on evaluating UAS technology for a broad range of case studies relating to the specific needs of the New Hampshire Department of Transportation (NH DOT). This project was a partnership between NH DOT and the University of Vermont's (UVM) UAS Team. UVM's UAS Team conducted flight operations and generated products for eight case studies. These case studies served the purpose of evaluating the applicability of UAS for NH DOT, comparing UAS to existing methods and analyzing the barrier to UAS implementation.

CASE STUDIES OVERVIEW

- Accident
  New Hampshire Motor Speedway
- Aeronautics Inspection
  Jaffrey Airport
- Bridge Inspection
  Lebanon, NH
- Construction Monitoring
  I-93
- Emergency Management
  Murphy Dam
- Traffic Monitoring
  I-95 & Franconia Notch State Park
- Rail Mapping & Bridge Inspection
  Lancaster, NH
- Rock Slope Inspection
  Crawford Notch State Park

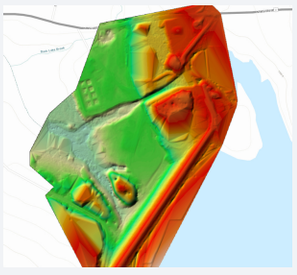
WORK FLOW

Planning
↓
Flight Operations
↓
Data Processing
↓
Value Added
↓
Products

DATA PRODUCTS

ORTHO MOSAIC

DIGITAL ELEVATION MODEL



INSPECTION PHOTOS

3D POINT CLOUD

AERIAL PHOTOS/VIDEOS

VIRTUAL REALITY

MORE INFORMATION

For more information on NH DOT case studies project view the **final report**.

View each case studies **Story Map** and **Fact Sheet** for more detailed information on each case study.

UAS BENEFITS

- Cost saving
- Safer & faster than traditional methods
- Ability to access difficult locations
- GIS/CAD ready data

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 40 minutes)
- System malfunction
- Often cannot be used stand alone

CONSIDERATIONS

- Volume of data
- Expertise required
- Specialized equipment
- GIS/CAD expertise

Accident UAS Case Study

NH Motor Speedway - Loudon, NH

Documenting an accident requires a combination of broad area mapping and close-range inspections. Unmanned Aircraft Systems (UAS) have unique capabilities that allow them to meet both needs efficiently and effectively. This project showed that current UAS technology can speed up the process of documenting an accident. The chief challenge for NH DOT in maximizing UAS for this purpose is the technical know-how to integrate the geospatial and inspection products into their existing systems and workflows.

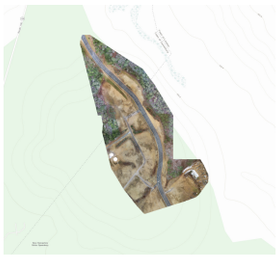
PROJECT OVERVIEW

- Mapped the accident and surrounding area
- Accident inspection
- Decision support products
- Evaluated the application of UAS for accident response

A multi-rotor UAS called the DJI Phantom 4 was flown to collect photos and videos of the accident and surrounding area.

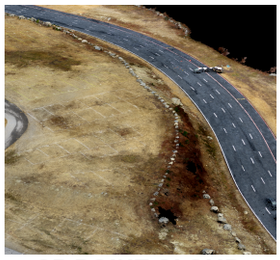
A fixed wing UAS called the senseFly eBee RTK was flown to collect images to create derived geospatial datasets.

DATA PRODUCTS



ORTHO MOSAIC

Overhead imagery, orthorectified, 3-band, true color, horizontal accuracy up to +/- 1cm (hard ground surfaces), GIS/CAD



3D POINT CLOUD

Photogrametrically derived point cloud in produced from image matching key points from allphotos. Vertical accuracy as good as +/- 1cm (hard ground surfaces)

PHOTOS/VIDEOS

Overhead photos, true color, JPG format

Overhead videos, true color, 4K at 30 frames per second, MP4 format

VIRTUAL REALITY

360 view of the accident scene hosted on an online platform called Hangar 360. The Hangar 360 can be viewed here.

UAS BENEFITS

- Safer & faster than traditional methods
- Virtual reality products
- GIS/CAD ready data
- Cost saving $$

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 40 minutes)
- Equipment malfunction
- Fixed-wing UAS cannot be used for all accident sites

CONSIDERATIONS

- Volume of data
- Expertise required
- Specialized equipment
- GIS/CAD expertise
- Site & traffic conditions

MORE INFORMATION

View this Story Map for more detailed information on this case study.

For more information on NH DOT case studies visit the project final report.

Aeronautic UAS Case Study

Jaffrey Airport - Jaffrey, NH

An Annual Airport Safety Inspection (5010 Inspection) requires a combination of broad area mapping and close-range inspections. Unmanned Aircraft Systems (UAS) have unique capabilities that allow them to meet both needs efficiently and effectively. This project showed that current UAS technology can dramatically speed up the process of the 5010 inspection. The primary challenge for NH DOT in maximizing UAS for this purpose is the technical knowledge to integrate the topographic survey data into their existing systems and workflows.

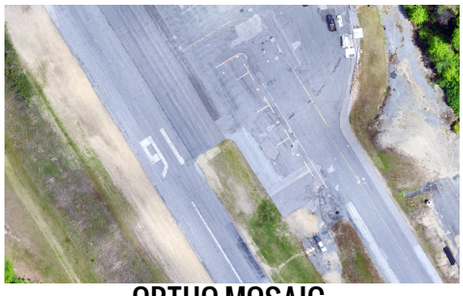
PROJECT OVERVIEW

- Mapped the airport and approaches
- Airport inspection data obtained
- Decision support products
- Evaluated the application of UAS for inspecting airports

A fixed wing UAS called the senseFly eBee Plus was flown to collect images to create derived geospatial datasets.

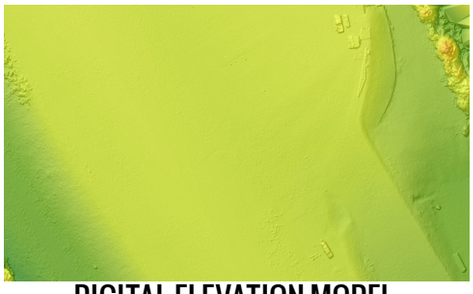
Due to high winds on June 2nd, 2017, the UAS Team was unable to capture imagery for the approaches that day. On October 4th, 2017, the UAS Team returned to acquire imagery of the northern and southern approaches.

DATA PRODUCTS



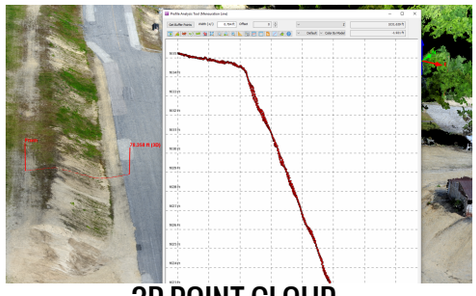
ORTHO MOSAIC

Overhead imagery, orthorectified, 3-band, true color, 1.2 in pixel size, horizontal accuracy up to +/- 1cm (hard ground surfaces), GIS/CAD ready



DIGITAL ELEVATION MODEL

Photogrammetrically derived raster elevation model generated from the point cloud, resolution as good as 5cm, GIS/CAD ready. The above image is same extent of the imagery, but displaying the DEM.



3D POINT CLOUD

Photogrametrically derived point cloud is produced from image matching key points from all photos. Vertical accuracy as good as +/- 1cm (hard ground surfaces)

UAS BENEFITS

- Cost saving $$
- Safer & faster than traditional methods
- High resolution imagery that can be used for pavement inspection
- GIS/CAD ready data

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 40 minutes)
- Equipment malfunction
- Good as screening tool only

CONSIDERATIONS

- Volume of data
- Expertise required
- Specialized equipment
- GIS/CAD expertise

MORE INFORMATION

View the Story Map for more detailed information on this case study.

For more information on NH DOT case studies visit the project final report.

Bridge Inspection UAS Case Study

Lebanon, NH

Inspecting a bridge requires close-range inspections. Unmanned Aircraft Systems (UAS) have unique capabilities that can inspect a bridge efficiently and effectively. This project showed that current UAS technology can dramatically speed up the process of a general bridge inspection. The chief challenge for NH DOT in maximizing UAS for this purpose is the technical know-how to integrate the inspection products into their existing systems and workflows.

PROJECT OVERVIEW

- Bridge inspection
- Decision support products
- Evaluated the application of UAS for inspecting critical bridge infrastructure

A multi-rotor UAS called the senseFly Albris was flown to collect still images of the bridge and surrounding area.

A multi-rotor UAS called the DJI Phantom 4 was flown to collect aerial videos and photos of the bridge and surrounding area.

DATA PRODUCTS

INSPECTION PHOTOS

High resolution inspection photos in true color and thermal photos. Ability to acquire photos of hard to reach and awkward angles.

AERIAL PHOTOS & VIDEOS

High resolution photos in true color photos.

UAS BENEFITS

- Cost saving $$
- Safer & faster than traditional methods
- Ability to access some difficult locations via camera zoom. Not for in-truss inspection locations.

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 30 minutes)
- System malfunction
- Cannot do close-in or tactile inspection

CONSIDERATIONS

- Expertise required
- UAS operator location to operate safely
- Requires additional field work to identify or carry our repairs.

MORE INFORMATION

View this Story Map for more detailed information on this case study.

For more information on NH DOT case studies visit the project final report.

Construction UAS Case Study

14633B Project - Derry & Windham, NH

Construction monitoring can often be a timely and intensive process through manual means. Unmanned Aircraft Systems (UAS) have unique capabilities that allow these tasks to be completed efficiently and effectively. This project showed that current UAS technology can dramatically speed up the process of construction monitoring. The chief challenge for NH DOT in maximizing UAS for this purpose is the technical know-how to integrate the geospatial and inspection products into their existing systems and workflows.

PROJECT OVERVIEW

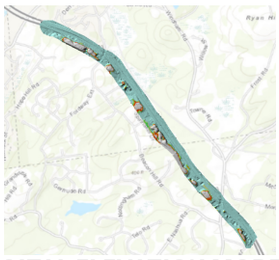
- Mapped the active construction and surrounding area
- Decision support products
- Evaluated the application of UAS for inspecting construction

A fixed wing UAS called the senseFly eBee Plus was flown to collect images to create derived geospatial datasets.

DATA PRODUCTS

ORTHO MOSAIC

Overhead imagery, orthorectified, 3-band, true color, 2 in pixel size, horizontal accuracy up to +/- 1cm (hard ground surfaces), GIS/CAD



DIGITAL ELEVATION MODEL

Photogrametrically derived raster elevation model generated from the point cloud, resolution as good as 5cm, GIS/CAD

3D POINT CLOUD

Photogrammetrically derived point cloud was produced from image matching key points from all photos. Vertical accuracy as good as +/- 1cm (hard ground surfaces)

UAS BENEFITS

- Cost saving $$$
- Safer & faster than traditional methods
- Data can be viewed by personnel not on site
- GIS/CAD ready data that can be used to make rapid measurements

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 40 minutes)
- Equipment malfunction
- Cannot fly over people so activities may need to be paused for flights

CONSIDERATIONS

- Volume of data
- Expertise required
- Specialized equipment
- GIS/CAD expertise
- UAS operator location

MORE INFORMATION

View this Story Map for more detailed information on this case study.

For more information on NH DOT case studies visit the project final report.

Dam UAS Case Study

Murphy Dam - Pittsburg, NH

Assessing risk from dams requires a combination of broad area mapping and close-range inspections. Unmanned Aircraft Systems (UAS) have unique capabilities that allow them to meet both needs efficiently and effectively. This project showed that current UAS technology can dramatically speed up the process of dam risk assessment. The chief challenge for NH DOT in maximizing UAS for this purpose is the technical know-how to integrate the geospatial and inspection products into their existing systems and workflows.

PROJECT OVERVIEW

- Mapped the dam and surrounding area
- Dam inspection
- Decision support products
- Evaluated the application of UAS for inspecting critical infrastructure

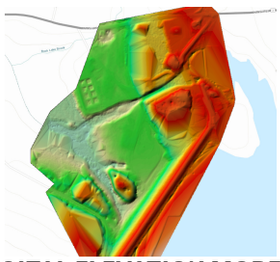
A multi-rotor UAS called the senseFly Albris was flown to collect still images of the dam and surrounding area.

A fixed wing UAS called the senseFly eBee Plus was flown to collect images to create derived geospatial datasets.

DATA PRODUCTS

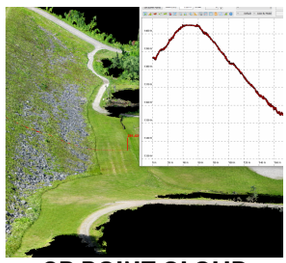
ORTHO MOSAIC

Overhead imagery, orthorectified, 3-band, true color, 1.2 in pixel size, horizontal accuracy up to +/- 1cm (hard ground surfaces), GIS/CAD



DIGITAL ELEVATION MODEL

Photogrammetrically derived raster elevation model generated from the point cloud, resolution as good as 5cm, GIS/CAD



3D POINT CLOUD

Photogrammetrically derived point cloud was produced from image matching key points from all photos. Vertical accuracy as good as +/- 1cm (hard ground surfaces)

INSPECTION PHOTOS

High resolution inspection photos in true color and thermal photos. Ability to acquire photos of hard to reach and awkward angles, but not closer to the structure.

UAS BENEFITS

- Cost saving $$$
- Safer & faster than traditional methods
- Ability to access difficult to reach locations
- GIS/CAD ready data

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 40 minutes)
- Equipment malfunction
- Cannot be used stand alone to inspect dams. Good as a screening tool only.

CONSIDERATIONS

- Volume of data
- Expertise required
- Specialized equipment
- GIS/CAD expertise
- Location of UAS operator

MORE INFORMATION

View this Story Map for more detailed information on this case study.

For more information on NH DOT case studies visit the project final report.

Rail & Bridge UAS Case Study

Lancaster, NH

Mapping rail lines and inspecting a bridge requires a combination of broad area mapping and close-range inspections. Unmanned Aircraft Systems (UAS) have unique capabilities that allow them to meet both needs efficiently and effectively. This project showed that current UAS technology can dramatically speed up the process of a general rail and bridge inspection. The chief challenge for NH DOT in maximizing UAS for this purpose is the technical know-how to integrate the geospatial and inspection products into their existing systems and workflows.

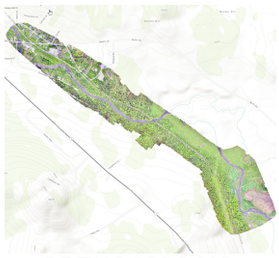
PROJECT OVERVIEW

- Mapped the rail track and surrounding area
- Bridge inspection
- Decision support products
- Evaluated the application of UAS for inspecting crital infrastructure

A multi-rotor UAS called the senseFly Albris was flown to collect still images of the rail, bridge, and surrounding area.

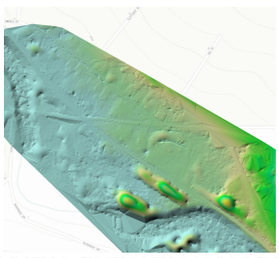
A fixed wing UAS called the senseFly eBee Plus was flown to collect images to create derived geospatial datasets.

DATA PRODUCTS



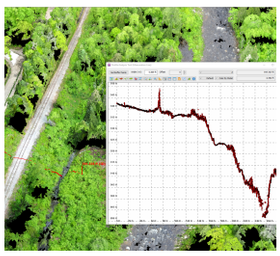
ORTHO MOSAIC

Overhead imagery, orthorectified, 3-band, true color, 1.2 in pixel size, horizontal accuracy up to +/- 1cm (hard ground surfaces), GIS/CAD



DIGITAL ELEVATION MODEL

Photogrammetrically derived raster elevation model generated from the point cloud, resolution as good as 5cm, GIS/CAD



3D POINT CLOUD

Photogrammetrically derived point cloud was produced from image matching key points from all photos. Vertical accuracy as good as +/- 1cm (hard ground surfaces)

INSPECTION PHOTOS

High resolution inspection photos in true color and thermal photos. Ability to acquire photos of hard to reach and awkward angles. Inspection photos suitable for scanning only.

UAS BENEFITS

- Cost saving $
- Safer & faster than traditional scanning methods
- Ability to access difficult site locations, but not suitable for in-truss inspection locations
- GIS/CAD ready data

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 40 minutes)
- System malfunction
- Cannot be used stand alone to inspect bridges. Used for scanning only.

CONSIDERATIONS

- Volume of data
- Expertise required
- Specialized equipment
- GIS/CAD expertise
- UAS operator location
- Track utilization

MORE INFORMATION

View this Story Map for more detailed information on this case study.

For more information on NH DOT case studies visit the project final report.

Rock Slope UAS Case Study

Crawford Notch State Park

A rock slope inspection can be a timely, intensive, and even dangerous process through manual means. Unmanned Aircraft Systems (UAS) have unique capabilities that allow these tasks to be completed efficiently, effectively, and safely. This project showed that current UAS technology can dramatically speed up the process of a rock slope inspection. This case study is one of the easiest for NH DOT to integrate into their existing systems and workflows. Capturing inspection photos does not require the technical knowledge to process and analyze geospatial products.

PROJECT OVERVIEW

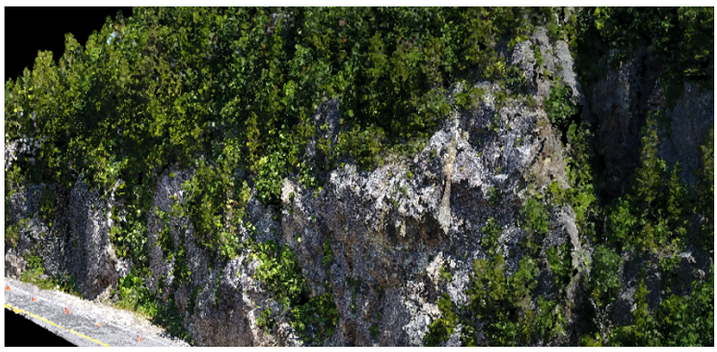
- Mapped the rock slope and surrounding area
- Rock slope inspection
- Decision support products
- Created point cloud using UAS to analyze rock structure and slope stability

The DJI Phantom 4 is a quad-copter platform with a high performance camera that can shoot video in 4K at 30 frames per second. The UAS team had four batteries for the DJI Phantom with each battery capable of a ~25 minute flight. This project took 2 UAS flights to acquire the necessary data. It takes under five minutes to set up the drone for each flight.

DATA PRODUCTS

INSPECTION PHOTOS

Overhead photos, true color, JPG format



3D POINT CLOUD

Photogrammetrically derived point cloud was produced from image matching key points from all photos. Vertical accuracy as good as +/- 1cm (hard ground surfaces)

UAS BENEFITS

- Cost saving $$
- Safer & faster than traditional methods
- Aerial perspective
- Data can be uploaded to online platforms

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 minutes)
- Equipment malfunction
- Cannot fly over people or vehicles without waiver

CONSIDERATIONS

- Volume of data
- Expertise required
- UAS operator location
- Photogrammetry cannot penetrate tree canopy while LiDAR can.

MORE INFORMATION

View the Story Map for more detailed information on this case study.

For more information on NH DOT case studies visit the project final report.

Traffic Monitoring UAS Case Study

I-95 - Portsmouth, NH & Franconia State Park

Traffic monitoring can often be a timely and intensive process through manual means. Unmanned Aircraft Systems (UAS) have unique capabilities that allow these tasks to be completed efficiently and effectively. This project showed that current UAS technology can dramatically speed up the process of traffic monitoring. This case study is the easiest for NH DOT to integrate into their existing systems and workflows as it does not require the technical knowledge to process and analyze geospatial products.

PROJECT OVERVIEW

- Acquired aerial photos and videos of traffic flow and parked vechicles
- Decision support products
- Evaluated the application of UAS for traffic monitoring

The DJI Phantom 4 is a quad-copter platform with a high performance camera that can shoot video in 4K at 30 frames per second. The UAS team had four batteries for the DJI Phantom with each battery capable of a ~25 minute flight. It takes under five minutes to set up the drone for each flight for a total of 8 flights.

DATA PRODUCTS

PHOTOS

Overhead photos, true color, JPG format

VIDEOS

Overhead videos, true color, 4K at 30 frames per second, MP4 format

UAS BENEFITS

- Cost saving $$
- Safer & faster than traditional methods
- Ability to upload to YouTube and other online platforms
- Data can be viewed by personnel not on site

UAS LIMITATIONS

- Weather (No rain or high winds)
- Battery life (20 to 40 minutes)
- Equipment malfunction
- Cannot fly over people, vehicles without a waiver

CONSIDERATIONS

- Volume of data
- Expertise required
- Privacy. Land owner permission. Visibility to public
- UAS operator locations

MORE INFORMATION

View the Story Map for more detailed information on the Franconia State Park case study.

View the YouTube video for the final product of the I-95 traffic monitoring.

For more information on NH DOT case studies visit the project final report.